Standard Model of Thickness

Variation for Composite Materials

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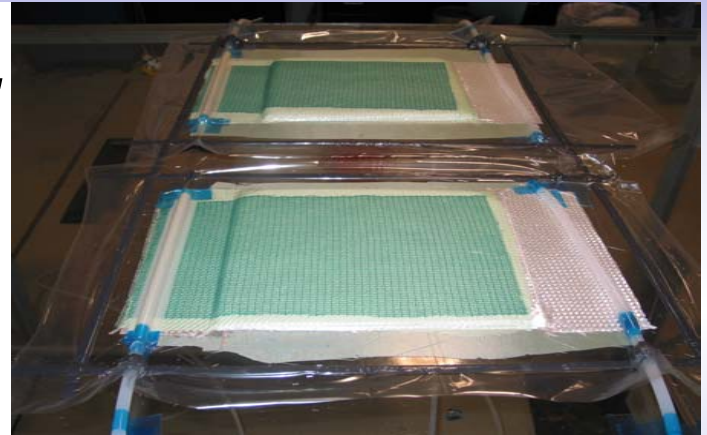**Army Research Laboratory**
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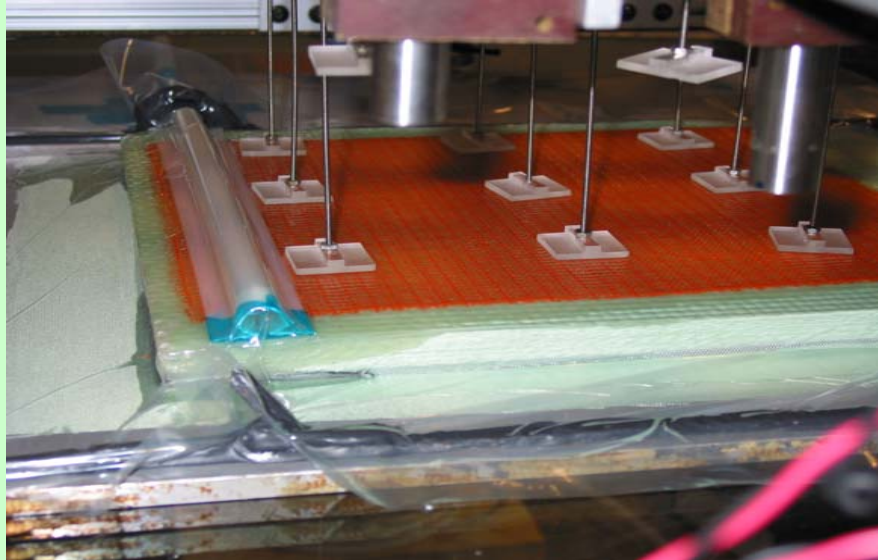**Mentor: Dr. Shawn M. Walsh**

What are Composites?

- High-performance polymers reinforced with fibrous materials.

- Used in many applications (boat hulls, fishing rods, armor)

- Processes
  - Autoclaving
  - Resin Transfer Molding (RTM)
  - Vacuum Assisted Resin Transfer Molding (VARTM)

Set of Experiments

- *11 panels (6 preforms, 5 hand lay-ups)*

- *Each preform:*
  - *30inHG vacuum*
  - *24 plies S-2 glass and 11 plies IM-7 graphite*
  - *Feed line opposite Vacuum line*
  - *SC-15 resin*

Linear Variable Differential Transducer (LVDT)

- Array of transducers that consist of a metal rod inside a metal tube

- As the rod moves inside the tube, a resistance is measured.

- This resistance can be translated into a change in thickness

- 9 or 12 transducers placed over each panel to measure at specific points.

Results

- **11 graphs of "Change in Thickness vs. Time" were collected from the LVDT by computer.**

- **They were analyzed and a standard model was created.**
  - Avg. change in thickness
  - Avg. resin clamp time
  - General curvature of graph.

Model Graph

Change in Thickness

Time

——	LVDT 0 output (in)
——	LVDT 1 output (in)
——	LVDT 2 output (in)
——	LVDT 5 output (in)
——	LVDT 6 output (in)
——	LVDT 7 output (in)
——	LVDT10 output (in)
——	LVDT11 output (in)
——	LVDT12 output (in)